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ABSTRACT

This document contains the course syllabus and 12 independent practice modules for a college pre-calculus designed as the first course in a two-semester sequence for students in a Bachelor of Technology program. The course emphasizes engineering technology applications and verbal problems. Topics include a review of elementary algebra; factoring and algebraic fractions; exponents and radicals; rectangular coordinates and functions; systems of linear equations; straight lines; quadratic equations; and trigonometry of the right triangle. Information given in this syllabus includes: (1) textbook; (2) references; (3) grading criteria; (4) course description; (5) prerequisites; (6) behavioral objectives; and (7) course outline. (CW)

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NEW YORK INSTITUTE OF TECHNOLOGY
CENTER FOR THE NATURAL SCIENCES
DEPARTMENT OF MATHEMATICS

COURSE OUTLINE

MATH 3310 - TECHNICAL MATHEMATICS I

PREREQUISITE: MATH 3007, 3013 OR EQUIVALENT

INSTRUCTOR:_____ OFFICE TELEPHONE:_____

OFFICE LOCATION:_____ OFFICE HOURS:_____

GRADING CRITERIA:

Exams (3)	48%
Quizzes	12
Homework Modules	12
Final (departmental and comprehensive)	28
	100%

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No one will be exempted from the final exam. The final exam grade itself must be higher than 40, regardless of the quiz/exam average, in order to pass the course.

COURSE DESCRIPTION:

This is both the first course in the sequence of mathematics courses for students in the Bachelor of Technology program and also the first semester of a full-year pre-calculus course for students in other disciplines. The course will include a review of elementary algebra; factoring and algebraic fractions; exponents and radicals; rectangular coordinates and functions; systems of linear equations; straight lines; and quadratic equations; and trigonometry of the right triangle. Applications are made to problems in engineering technology. Verbal problems will be emphasized throughout.

BEHAVIORAL OBJECTIVES:

The course will provide the necessary background in algebra and trigonometry for the student to be successful in the second half (3320) and in subsequent calculus courses. The student will develop a feeling for mathematical methods, and in particular, a fluent background in algebraic techniques.

TEXTBOOK:

BASIC TECHNICAL MATHEMATICS, Peter K.F. Kuhfitting, Brooks/Cole Publishing, 1984.

REFERENCES:

ALGEBRA AND TRIGONOMETRY: A FUNCTIONS APPROACH, Keedy and Bittinger, Third Edition, Addison-Wesley Publishing Co.

BASIC TECHNICAL MATHEMATICS, Allyn J. Washington, Third Edition, Benjamin Cummings Publishing Co.

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NEW YORK INSTITUTE OF TECHNOLOGY

Center for the Natural Sciences

Department of Mathematics

Math 3310: Technical Mathematics I*
Textbook: Basic Technical Mathematics, Peter K. F. Kuhfitting, Brooks/Cole Pub. Co., 1984
Fall 1985/Spring 1986

Module	Lesson	Section	Topic	Assignment**
1	1	1.1	Numbers	p.8: 11-19
	2	1.2,1.3	Four Fund Operations, Zero	p.8: 2-8(evens),23,25,32,35,38, 50,51,56
	3	1.4,1.5	Polynomials,Add. & Subt. of Polynomials	pp.13-15: 4,7,10,16,25,29,32,35
	4	1.6	Symbols of Grouping	p.17: 5,8,11,14,20,32
2	5,6	1.7	Exponents & Radicals	pp.23-25: 2,8,14,17,23,29,32,41, 47,50,56,67,76,79
	7,8	1.8	Mult. of Polynomials	pp.28-29: 1,9,14,19,29,34,39,45, 54,57
	9,10	1.9	Division of Polynomials	pp.33-34: 7,12,26,27,32,33
3	11	1.10,1.11	Approx., Signif. Figures and Scientific Notation	p.37: 1,4,7,19,25 pp.42-43: 2,5,11,14,25,32,39
	12,13	2.1,2.2	Equations	p.48: 6,11,14 p.54: 15,18,21,27,33,39,46,49,55
	14,15	2.3	Applications of Equations	pp.59-60: 3,8,13,16,22
4	16,17	2.6	Functions and Graphs	p.74: 2,3,6-10(domain),13,14,15
	18	2.7	Notation for Functions	p.76: 1,3,11,12 Find fog(x) and gof(x)
			Supplement Composite Functions	1. $f(x) = 3x^3-1, g(x) = \frac{2}{x}$ 2. $f(x) = 3x-4, g(x) = 2x^2-5$
	19	19.3	Slope	pp.581-582: 8,11a,c,d; 12,13,21
	20,21	19.4	The Straight Line	p.585: 3,6,9,13,20,23,26,27
5	22	3.1	Systems of Two Eqtns-- Graphically	p.84: 4,7,10
	23,24	3.2	Systems of Two Eqtns-- Algebraically	pp.90-91: 9,14,17,27
	25	3.3	Intro. to Determinants	pp.95-96: 7,9,15,18,19,28
	26	3.5	Systems of Three Eqtns-- Algebraically***	p.103: 2,5,8
6	27,28	3.4	App'n. of Systems of Eqtns	p.100: 7,9,20,21,24 p.112: 25,27
	29	5.1,5.3	Special Products	pp.150-151: 2,6,10,14,16 pp.160-161: 2,8,14,20,26,31,37
	30,31	5.2,5.4,5.5	Factoring	pp.156-157: 6,12,18,36,39,48,51 p.166: 2,11,23,26 p.169: 4,8,13,23,26

Module	Lesson	Section	Topic	Assignment
7	32	5.6	Equivalent Fractions	p.174: 9,15,27,39
	33	5.7	Mult. & Div. of Fractions	p.178: 6,13,23,12,31
	34,35	5.8	Add. & Subt. of Fractions	pp.183-184: 4,9,15,20,30
8	36	5.9	Complex Fractions	pp.188-189: 3,8,13,14,26,28
	37	5.10	Fractional Eqtns.	pp.193-194: 10,14,17,20,26, 32,33
	38	6.1	Quad. Eqtns.-Factoring	p.203: 8,19,28,31
	39,40	6.2	Quad. Eqtns.-Comp the Square	p.208: 3,6,13,26
9	41	6.3	Quad. Eqtns.-Formula	p.213: 5,11,14,24,30
	42		Supplement Quad. Eqtns.-Nature of Roots Using Graphs and Discriminant	
	43	4.1,4.2	Angles	p.123: 1f,h; 2a,d; 3,5,16
	44,45	4.3	Trigonometric Functions	pp.129-130: 6,9,22,24,31,42
10	46,47	4.4	Values of Trig. Functions (No Interpolations)	pp.137-138: 4,12,20,28,36, 43-46,61-64
	48,49	4.5	App'ns. of Right Triangles	pp.143-145: 4,8,9,17,20,21,24
11	50	10.1	Exponents - Review	pp.301-302: 5,8,14,20,32,35,41
	51	10.2	Exponents - Zero & Negative Integers	pp.307-308: 2,7,13,14,26,43, 48,51
	52	10.3	Exponents - Fractional	pp.311-312: 5,8,14,17,22,29, 36,51
	53	10.4	Simplest Radical Form Add. & Subt. of Radicals	pp.319-320: 2,6,14,17,24,37, 46,57
	54	10.5	Mult. of Radicals	pp.323-324: 1,6,15,24,28,42
	55	10.6	Div. of Radicals	pp.326-327: 4,9,14,21,26
12	56,57	13.2	Solving Systems of Eqtns. Algebraically	pp.406-407: 7,11,16,21,34
	58,59	13.3	Eqtns. in Quad. Form	p.411: 4,7,13,19,22
	60,61	13.4	Radical Equations	p.415: 5,10,15,16,18

This outline considers that the class will meet five hours per week for each of fourteen weeks allowing 61 lesson hours, 4 hourly exams and 5 review/additional lesson hours.

*All faculty teaching 3310 are to familiarize themselves with the current 3011 textbook (Algebra and Trigonometry: A Functions Approach, 2nd ed., Keedy and Bittinger) to assure that the depth and breadth of topics and question types are equivalent.

**Those assignments are to be used at the discretion of the faculty teaching 3310.

***If time permits, Section 3.6, 3x3 determinants and determinant solution of systems of three linear equations, is to be included.

Do the indicated operations. Simplify.

1. $|-3| - |3| - |-2|$

   a) 2 b) 4 c) 8 d) -2 e) none of these

2. $(1.02)(-1)(3.2)$

   a) 32.64 b) 3.264 c) -3.264 d) -32.64 e) -326.4

3. $\dfrac{(-3)(0)(-1)}{6-3}$

   a) 0 b) $-\frac{1}{2}$ c) 1 d) -1 e) none of these

4. $\dfrac{(-5)(3)(2)}{(10)(0)}$

   a) 3 b) -3 c) 0 d) $\frac{3}{2}$ e) none of these

5. $\dfrac{(\frac{1}{3})(0)(-3)}{(0)(5)(-\frac{1}{5})}$

   a) 1 b) -1 c) 0 d) $\frac{3}{5}$ e) none of these

6. $\frac{1}{8} + \frac{4}{5}$

   a) $\frac{7}{10}$ b) $\frac{37}{40}$ c) $\frac{5}{13}$ d) $\frac{32}{5}$ e) none of these

7. $(-\frac{3}{4}) - (-\frac{3}{8})$

   a) $-\frac{3}{8}$ b) $\frac{1}{2}$ c) $-1\frac{1}{8}$ d) $\frac{3}{8}$ e) 0

8. $3(-6)(-4) \div 6 + 3(2)$

   a) -18 b) 12 c) 18 d) -12 e) 6

9. $\dfrac{15 + (-5) \div (-1)}{5}$

   a) -2 b) 2 c) 15 d) 3 e) 4

10. $\frac{1}{2} + \frac{2}{3} \div \frac{2}{5}$

    a) $\frac{3}{2}$ b) $\frac{7}{15}$ c) $1\frac{1}{5}$ d) $24\frac{11}{12}$ e) $2\frac{1}{6}$

11. $4\frac{2}{5} - 3\frac{1}{2} \times 3\frac{1}{7}$

    a) $\frac{11}{5}$ b) $\frac{32}{5}$ c) $\frac{20}{35}$ d) $-\frac{33}{5}$ e) $-\frac{11}{5}$

12. $3xy^2 - 5xy - 7xy^2$

a) $-9xy^2$ b) $-5xy - 4xy^2$ c) $-9y$ d) $-9x^3y^5$ e) none of these

13. $2a^2bc + 3ab^2c + 5abc^2 - ab^2c + 2abc^2$

a) $11a^4b^4c^4$ b) $9a^2bc^2$ c) $a^2bc + 3ab^2c + 7abc^2$ d) $11a^3b^2c^3$
e) none of these

14. Find the sum of the given polynomials: $3a - 2b + ab$; $5a + b - 3ab$; $a + b + 2ab$

a) $3a + b + ab$ b) $9a$ c) $3a$ d) $3a + 3b + 3ab$ e) 0

Subtract the second expression from the first.

15. $7a + 11b$; $3a + 4b$

a) $4a + 7b$ b) $4a + 15b$ c) $10a + 15b$ d) $10a + 7b$
e) none of these

16. $5x - 3y$; $-7x - 10y$

a) $-2x - 13y$ b) $12x + 7y$ c) $12x - 13y$ d) $-12x - 7y$
e) none of these

17. $-8u + 7s + 3t$; $u - 5s + 2t$

a) $-7u + 2s + 5t$ b) $-9u + 2s + 5t$ c) $-9u + 2s + t$
d) $-9u + 12s + t$ e) none of these

Change each word expression into an algebraic expression.

18. Twice F less fifty

a) $50 - F$ b) $F - 50$ c) $2F - 50$ d) $50 - 2F$ e) $(2)(F - 50)$

19. x times the quantity six less than y

a) $x - y - 6$ b) $(x)(y - 6)$ c) $(x)(6 - y)$ d) $(x)(y)$ e) $xy - 6$

20. A square garden is surrounded by a fence costing \$7 per foot. If x represents the side of the square in feet, write the expression representing the cost of the fence.

a) $4x$ b) $28x$ c) x^2 d) $7x^2$ e) $28x^2$

21. A box contains x cans weighing 5 lb. each and y cans weighing 7 lb. each. Write the expression representing the total weight of the cans.

a) $x + y$ b) $5x + y$ c) $x + 7y$ d) $(5x)(7y)$ e) $5x + 7y$

Do the indicated operations. Simplify.

22. $2(x + y) - 3(x - y)$

a) $-x + 5y$ b) $-x - y$ c) $5x - y$ d) $5x + 5y$ e) $x + 5y$

23. $-[t + 3(t + s) - (t - 3s)]$

a) $6s + 3t$ b) $-6s - 3t$ c) $-3t$ d) $3t$ e) none of these

24. $2\{(F_1 - F_2) - 3(-2F_2 - F_1)\}$

a) $8F_1 + 10F_2$ b) $-4F_1 - 14F_2$ c) $4F_1 + 5F_2$ d) $-2F_1 + 5F_2$
e) $-4F_1 + 10F_2$

25. $-\{5x + 3(y - x) + 2[z - 5(x - z)]\}$

a) $-8x + 3y + 12z$ b) $3x - 3y - 7z$ c) $8x - 3y - 12z$
d) $-3x + 3y + 7z$ e) $x - 3y - z$

MATH 3310 - MODULE 2

Do the indicated operations. Simplify.

1. $(3n^2)^3 =$

   a) $9n^6$ b) $9n^5$ c) $6n^5$ d) $27n^6$ e) $27n^5$

2. $2x^0y^{-2}$

   a) $\frac{1}{y^2}$ b) $\frac{2}{y^2}$ c) $\frac{1}{y}$ d) $\frac{1}{2y^2}$ e) none of these

3. $(8x^5)(-5x^7y^2) =$

   a) $3x^{35}y^2$ b) $3x^2y^2$ c) $-40x^{12}y^2$ d) $-40x^{35}y^2$ e) $3x^{12}y^2$

4. $(3a^2b)(4a^3b)(a^2) =$

   a) $8a^5b^2$ b) $12a^{12}b$ c) $12a^7b^2$ d) $7a^7b$ e) $7a^{12}b^2$

5. $a^{-2}x(-a^2x)^2 =$

   a) $-x^3$ b) ax^3 c) $-a^2x^3$ d) $a^{-8}x^2$ e) a^2x^3

6. $48x^{-7} \div 6x^4 =$

   a) $-8x^{-3}$ b) $8x^{-11}$ c) $8x^{-3}$ d) $42x^{-3}$ e) none of these

7. $-\sqrt{144} + \sqrt{49} =$

   a) $-\sqrt{95}$ b) 19 c) $\sqrt{-95}$ d) -5 e) -19

8. $\sqrt{96} =$

   a) $4\sqrt{6}$ b) $2\sqrt{24}$ c) $16\sqrt{6}$ d) $3\sqrt{6}$ e) none of these

9. $\frac{2}{\sqrt{18}} =$

   a) $\frac{2}{3}$ b) $\sqrt{2}$ c) $\frac{\sqrt{2}}{3}$ d) $\frac{1}{3}$ e) none of these

10. $\frac{3}{2\sqrt{x}}$

    a) $\frac{6}{x}$ b) $\frac{3}{2x}$ c) $\frac{3\sqrt{x}}{2}$ d) $\frac{3\sqrt{x}}{2x}$ e) $\frac{6\sqrt{x}}{x}$

11. Multiply $-3x$ and $5x - 2$

    a) $-15x^2 + 6x$ b) $2x - 2$ c) $-15x^2 - 6x$ d) $15x^2 - 6x$
    e) none of these

12. $(x + 4y)(2x - 3y) =$

    a) $2x^2 + 5xy - 12y^2$ b) $2x^2 - 12y^2$ c) $3x + y$ d) $2x^2 - 12y^2 + 8yx$
    e) $2x^2 + 5xy + y^2$

13. $(3x - 2y)^2 =$

a) $9x^2 + 4y^2$ b) $9x^2 - 12xy + 4y^2$ c) $3x^2 + 2y^2$ d) $3x^2 + 2y^2 - 12xy$
e) $9x^2 - 6xy + 4y^2$

14. $(a + 3)(a + 2) + a + 3 =$

a) $2(a + 3)$ b) $(a + 3)^2$ c) $a^2 + 6a + 8$ d) $a^2 + a + 8$
e) $6a + 3$

15. $(a - 2b)^3 =$

a) $a^3 + 8b^3$ b) a^3 c) $a^3 - 6a^2b + 12ab^2 - 8b^3$
d) $a^3 - 4a^2b + 8b^2 - 8b^3$ e) $a^3 - 8b^3$

16. $(x + 3y)^2 - (x + 2y)^2 =$

a) $5y^2$ b) $2xy + 5y^2$ c) $10xy + 13y^2$ d) $13y^2$ e) $xy + 5y^2$

17. $(2y - 5)(2y + 5)$

a) $4y^2 + 25$ b) $4y^2 - 10y - 25$ c) $4y^2 - 20y - 25$ d) $4y^2 - 10y + 25$
e) $4y^2 - 25$

18. $(x - y + 1)^2$

a) $x^2 - y^2 + 1$ b) $x^2 - xy + 2x - y + 1$ c) $x^2 + y^2 + 1$
d) $x^2 - 2xy + y^2 + 2x - 2y + 1$ e) $x^2 - 2xy + y^2 + x - y$

19. $\dfrac{4a^6b^2}{3a^2b} =$

a) $\frac{4}{3}a^{12}b^2$ b) $\frac{4}{3}a^4b$ c) a^4b d) $12a^8b^3$ e) $\frac{4}{3}a^2b$

20. $(-26m^2x^2 + 39mx^2) \div (-13mx) =$

a) $-2mx + 3x$ b) $2mx + 3x$ c) $2mx - 3mx^2$ d) $2mx - 3x$
e) $2m^2x^2 - 3x$

21. $\dfrac{9x^7y^6z^{10} - 6x^8y^5z^4 + 12x^3y^4z^7}{3x^2y^3z^4} =$

a) $3x^5y^3z^6 - 2x^6y^2 + 4xyz^3$ b) $3x^5y^3z^6 - 6x^8y^5z^4 + 12x^3y^4z^7$
c) $5x^{16}y^{12}z^{17}$ d) $9x^7y^6z^{10} - 6x^8y^5z^4 + 4xyz^3$
e) $3x^{\frac{7}{2}}y^{\frac{5}{2}}z^{\frac{5}{2}} - 2x^6y^{\frac{5}{3}}z + 4x^{\frac{3}{2}}yz^{\frac{7}{4}}$

22. $(10x^2 - 23x + 12) \div (2x - 3) =$

a) $5x + 4$ b) $5x - 19 + \frac{-45}{2x - 3}$ c) $5x - 4$ d) $5x - 19 + \frac{45}{2x - 3}$

e) none of these

23. $\frac{b^2 + 1}{b - 1} =$

a) $b + 1 + \frac{2}{b - 1}$ b) $b - 1$ c) $b - 1 + \frac{2}{b - 1}$ d) $b + \frac{2}{b - 1}$

e) none of these

24. $(y^3 - 25y + 66) \div (y + 6)$

a) $y^2 - 31$, R 252 b) $y^2 + 6y + 11$ c) $y^2 - 25y + 11$

d) $y^2 - \frac{25}{6}y + 11$ e) $y^2 - 6y + 11$

25. $(t^3 - 4t^2 + 7t + 4) \div (t + 2)$

a) $t^2 - 2t + 3 + \frac{10}{t + 2}$ b) $t^2 - 6t + 19 + \frac{-34}{t + 2}$ c) $t^2 - 6t - 5 + \frac{14}{t + 2}$

d) $t^2 + 6t - 5 + \frac{-6}{t + 2}$ e) none of these

MATH 3310 - MODULE 3

Simplify and write answer to nearest tenth.

1. $12.41 - 4.5 + 7.325$

   a) 15.3 b) 15.2 c) 24.2 d) 25.2 e) 14.2

2. $(2.1)(3.2) + 1.7$

   a) 8.4 b) 5.0 c) 8.42 d) 7.4 e) 5.4

Convert the following numbers to scientific notation.

3. 0.0000000123

   a) 1.23×10^{-7} b) 12.3×10^{-9} c) 123×10^{-10} d) 1.23×10^{-8}
   e) 12.3×10^{-8}

4. 460,000,000

   a) 46×10^{7} b) 4.6×10^{8} c) 4.6×10^{7} d) 460×10^{6}
   e) 46×10^{8}

Compute and write answer in scientific notation.

5. $(9.1 \times 10^{-7})(8.2 \times 10^{3})$

   a) 75×10^{-4} b) 74.62×10^{-4} c) $.75 \times 10^{-3}$ d) 7.462×10^{-3}
   e) none of these

6. $\dfrac{4.2 \times 10^{5}}{0.21 \times 10^{-2}}$

   a) 2.0×10^{8} b) 2.0×10^{3} c) 0.2×10^{3} d) 0.2×10^{7}
   e) 2.0×10^{7}

7. $\dfrac{830,000,000 \times 0.0000012}{3,100,000}$

   a) 32.1×10^{-4} b) 0.3×10^{-4} c) 3.21×10^{8} d) 3.2×10^{8}
   e) 3.2×10^{-4}

Solve each equation for the unknown.

8. $4x + 6 = 2x - 4$

   a) 5 b) $\frac{1}{3}$ c) $-\frac{1}{3}$ d) -5 e) 1

9. $-4x + 2 + 5x = 3x - 14$

   a) -8 b) 6 c) -6 d) 4 e) 8

10. $4 + \frac{1}{2}x = 1$

a) -6 b) 6 c) $\frac{3}{2}$ d) $-\frac{3}{2}$ e) none of these

11. $4(5y + 3) = 3(4y - 4)$, then y lies between

a) 4 and 6 b) 2 and 4 c) 0 and 2 d) -2 and 0 e) -4 and -2

12. $2.2y - 5 + 4.5y = 1.7y - 20$

a) 4 b) 3 c) -3 d) -2 e) none of these

13. $5 - 4a = a - 13$

a) 3 b) -3 c) 2 d) 4 e) none of these

14. $5m - 3(2 + 3m) = 6$, then m lies between

a) 4 and 6 b) 2 and 4 c) 0 and 2 d) -2 and 0 e) -4 and -2

15. $4a - 3(5a - 14) = 5(7 + a) - 9$

a) 1 b) -1 c) no solution d) -3 e) 2

16. $\frac{1}{9}x + 2 = \frac{1}{6}x$

a) 3 b) 18 c) 6 d) 36 e) no solution

17. $x + 7 = x$

a) no solution b) 7 c) -7 d) 0 e) none of these

18. $\frac{2z - 4}{3} + \frac{3z}{2} = \frac{5}{6}$

a) 3 b) -2 c) -1 d) 2 e) 1

19. Solve for x: $2ab + 3x = 5ab - 2a$

a) $3ab - 2a - 3$ b) $\frac{3ab - 2a}{3}$ c) ab d) $\frac{ab}{3}$ e) $\frac{ab - a}{3}$

20. Solve for M: $2M - 5y = 7$

a) $\frac{5y}{2} + 7$ b) $\frac{1}{5}(2y - 7)$ c) $\frac{1}{2}(7 - 5y)$ d) $5y + \frac{7}{2}$ e) $\frac{1}{2}(5y + 7)$

21. A length of wire is 48 in. long. It must be cut into two pieces, one of which is twice as long as the other. Select the equation that leads to the solution of this problem.

a) $2x + y = 48$ b) $y = 48 + 2x$ c) $x = 12$ d) $3x = 48$

e) $x + 2y = 48$

22. The width of an office is 6 ft. more than half the length. If the perimeter is 138 ft., find the dimensions of the room. The length is

a) 38 b) 42 c) 46 d) 28 e) 32

23. A woman rode a bike for 3 hrs. at 20 m/hr and then walked for 2 hrs. If she travelled a total of 68 mi., select the equation that will enable you to find her walking speed.

a) $x = 5$ b) $60 + x = 68$ c) $2x + 60 = 68$ d) $x + 20 = 68$

e) $3x + 20 = 68$

24. How much pure acid should be added to 180 mL of a 15% solution to make a 25% solution? (answer in mL)

a) 24 b) 30 c) 18 d) 26 e) 32

25. Two planes travelling in opposite directions leave the same point at the same time. One is flying at a speed of 320 mi/hr. If they are 1700 miles apart after 2.5 hrs., how fast is the other plane travelling?

a) 320 mi/hr. b) 360 mi/hr. c) 420 mi/hr. d) 280 mi/hr.

e) 400 mi/hr.

State the domain of each of the following functions.

1. $y = 3x^2 - 27$

   a) no real numbers b) all real numbers c) all real numbers except 0
   d) all real numbers except 3 e) none of these

2. $y = \frac{4 + x}{x - 3}$

   a) no real numbers b) all real numbers c) all real numbers except 3
   d) all real numbers except (-4) e) all real numbers except 3 and (-4)

3. $y = 15$

   a) no real numbers b) all real numbers c) only number 15
   d) all real numbers except 15 e) all real numbers except 0 and 15

4. Given $f(x) = 2x^2 - 1$ then $f(0) =$

   a) 3 b) -2 c) 1 d) -1 e) does not exist

5. Given $h(t) = \sqrt{5t - 4}$ then $h(0) =$

   a) 2 b) -2 c) 1 d) -1 e) does not exist

6. Given $H(w) = \frac{w + 4}{w - 4}$ then $H(-4) =$

   a) 1 b) -1 c) 0 d) 2 e) does not exist

7. Given $G(s) = \frac{s}{s - 2}$ then $G(2) =$

   a) 2 b) -2 c) 1 d) -1 e) does not exist

8. Given $W(t) = -t^2 - 4$ then $W(-2) =$

   a) -8 b) 0 c) 8 d) -4 e) does not exist

9. Given $g(x) = -(3 - x)^2$ then $g(5) =$

   a) -4 b) 22 c) 4 d) -22 e) does not exist

10. Given $f(x) = 4x^5 + 1$ and $g(x) = 2x - 3$ then $(fog)(x) =$

    a) $(8x - 12)^5 + 1$ b) $8x^6 - 2$ c) $4(2x - 3)^5 + 1$
    d) $8x^6 - 12x^5 + 2x - 3$ e) $2(4x^5 + 1) - 3$

11. Given $h(x) = \frac{3}{x} + 4$ and $w(x) = 5x^2 - 1$ then $(how)(x) =$

    a) $\frac{3}{5x^2 - 1} + 4$ b) $5(\frac{3}{x} + 4)^2 - 1$ c) $15x - \frac{3}{x} + 20x^2 - 4$

    d) $(\frac{15}{x} + 20)^2 - 1$ e) none of these

12. Given $f(x) = 7$ then $f(2) =$

a) 14 b) 0 c) 7 d) -14 e) does not exist

13. Given $f(x) = 7$ then $f(0) =$

a) 0 b) 7 c) 1 d) $\frac{1}{7}$ e) does not exist

In each, find the slope of the line passing through the given points.

14. (2,4) and (-3,6)

a) $-\frac{5}{2}$ b) $-\frac{2}{5}$ c) $\frac{2}{5}$ d) 2 e) does not exist

15. (-7,7) and (4,7)

a) $\frac{14}{11}$ b) $-\frac{11}{14}$ c) 0 d) $-\frac{14}{11}$ e) does not exist

16. (-5,10) and (-5,15)

a) $-\frac{1}{2}$ b) -2 c) $\frac{1}{2}$ d) 2 e) does not exist

17. The slope of any line perpendicular to the line through (3,5) and (7,8) is

a) $\frac{3}{4}$ b) $-\frac{4}{3}$ c) $\frac{4}{3}$ d) $-\frac{3}{4}$ e) does not exist

18. The slope of any line perpendicular to the line through (1,2) and (5,2) is

a) 0 b) -1 c) 1 d) $\frac{1}{2}$ e) does not exist

19. An equation of the line passing through (-2,7.1) and (-2,8.1) is

a) $y = -2$ b) $x = -2$ c) $y = x + 7.1$ d) $y = x + 8.1$
e) none of these

20. An equation of the line with slope 3 and x-intercept of 4 is

a) $y = 3(x - 4)$ b) $y = 3x + 4$ c) $y = 4x + 3$ d) $y = 4(x - 3)$
e) none of these

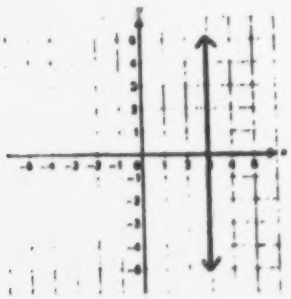
21. Given the line $-3x + 4y + 7 = 0$, the slope of any other line parallel to the given line is

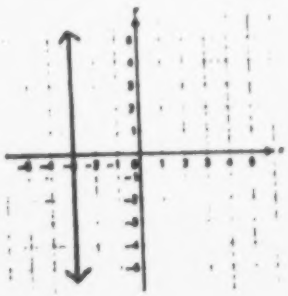
a) 3 b) $\frac{3}{4}$ c) $-\frac{4}{3}$ d) $-\frac{3}{4}$ e) -3

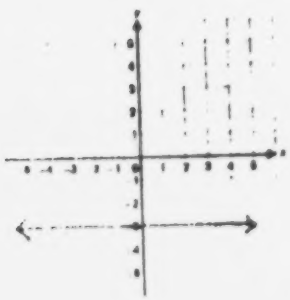
22. Given the line $2x + 5y - 15 = 0$, the slope of any other line perpendicular to the given line is

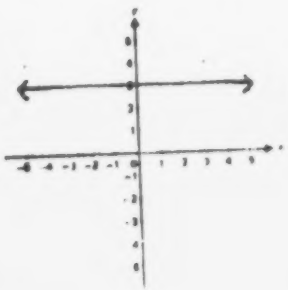
a) $-\frac{1}{2}$ b) $-\frac{2}{5}$ c) $\frac{5}{2}$ d) $-\frac{5}{2}$ e) $\frac{1}{2}$

23. Draw the graph $4x - 12 = 0$. The graph looks like which of the following choices?

a) 

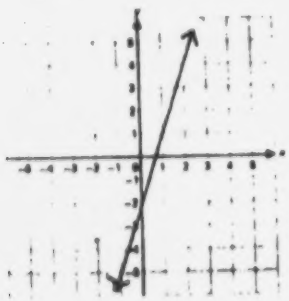
b) 

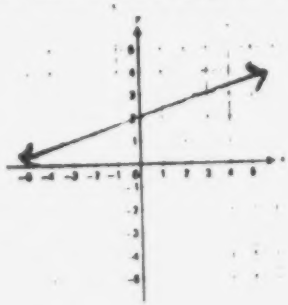
c) 

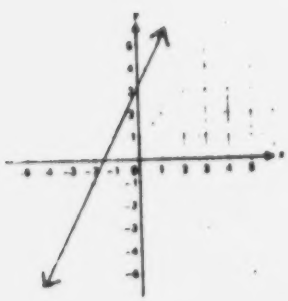
d) 

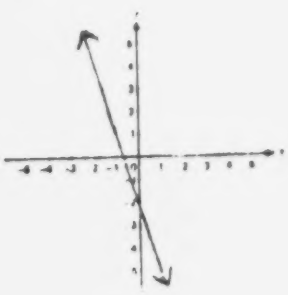
e) none of these

24. Determine the slope and y-intercept of $y - 3x + 2 = 0$. Use these to draw the graph. The graph looks like which of the following choices?

a) 

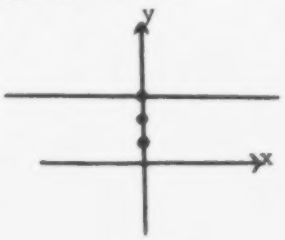
b) 

c) 

d) 

e) none of these

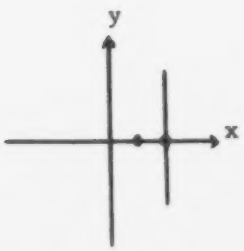
25. Find an equation of the line passing through (3,2) and having slope 0, and graph the line.

a) 

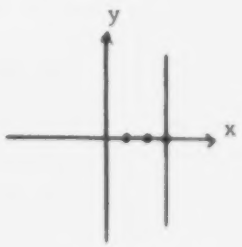
y = 3

b)

y = 2

c) 

x = 2

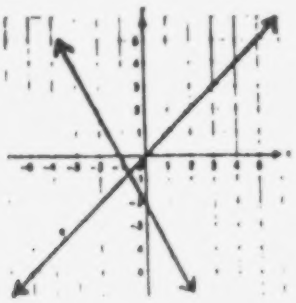
d) 

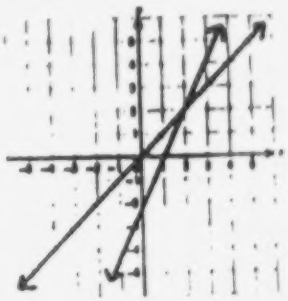
x = 3

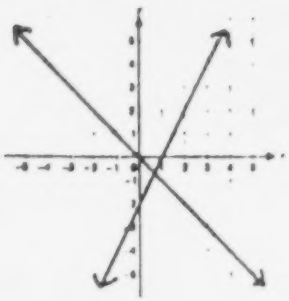
e) none of these

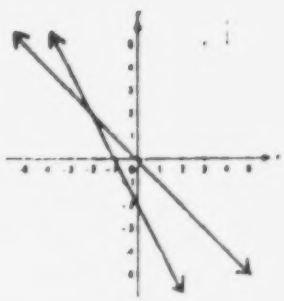
1. Solve graphically the system of equations: $4x - 2y = 4$
$x - y = 0$

The graph looks like which of the following choices?

a) 

b) 

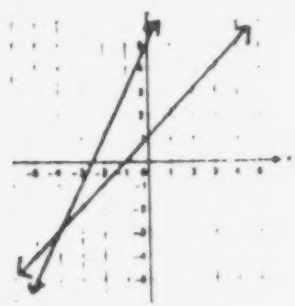
c) 

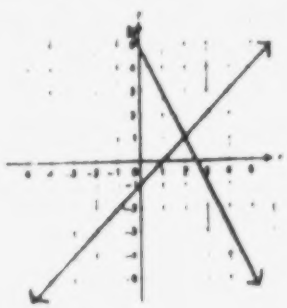
d) 

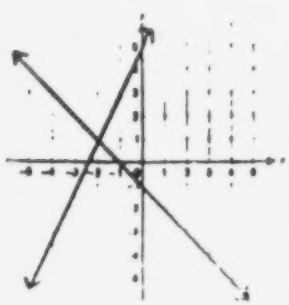
e) none of these

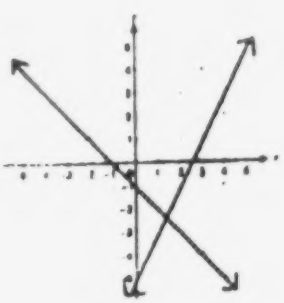
2. Solve graphically the system of equations: $x + y = -1$
$-2x + y = 5$

The graph looks like which of the following choices?

a) 

b) 

c) 

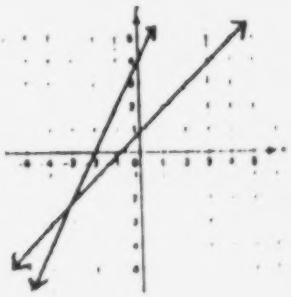
d) 

e) none of these

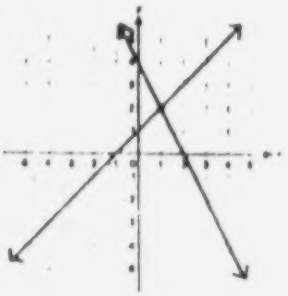
3. Solve graphically the system of equations: $x + y = 1$
$2x + y = 4$

The graph looks like which of the following choices?

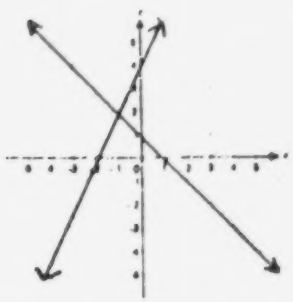
a)



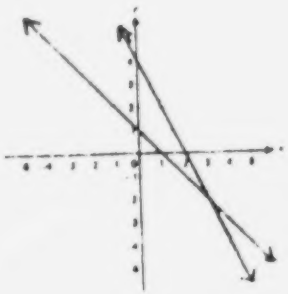
b)



c)



d)

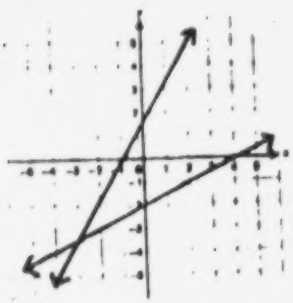


e) none of these

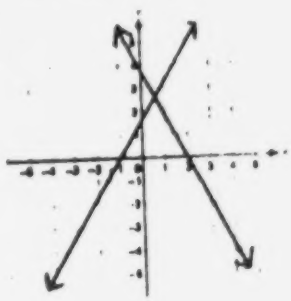
4. Solve graphically the system of equations: $x - 3y = -1$
$2x + y = 0$

The graph looks like which of the following choices?

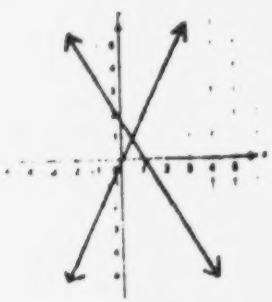
a)



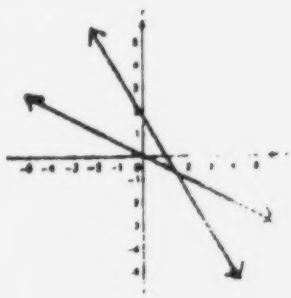
b)



c)



d)



e) none of these

Solve each system of equations by the method of addition or subtraction.

5. $x + 2y = 4$
   $-2x + y = 2$
   Find (x,y)

   a) $(0,2)$ b) $(-1,0)$ c) $(4,0)$ d) $(2,1)$ e) no solution

6. $3x - 8y = -1$
   $-5x + 8y = 7$
   Find $x + y$

   a) 7 b) -4 c) 18 d) 2 e) none of these

7. $x + 2y = -1$
   $3x + 5y = -4$
   Find $x - y$

   a) -1 b) -4 c) 4 d) 5 e) no solution

8. $5x - y = 5$
   $6x - 2y = 2$
   Find $y - x$

   a) 3 b) -5 c) -1 d) 1 e) none of these

9. $2x - 3y = 3$
   $3x - 4y = 3$
   Find (x,y)

   a) $(3,1)$ b) $(9,5)$ c) $(9,6)$ d) $(3,-3)$ e) none of these

10. $x - 3y = 3$
    $-2x + 6y = 4$
    Find $x + y$

    a) 2 b) 3 c) -1 d) 6 e) no solution

Solve each system of equations using the substitution method.

11. $3x + y = 1$
    $7x + 3y = 5$
    Find (x,y)

    a) $(1,-2)$ b) $(2,-5)$ c) $(2,-3)$ d) $(-1,4)$ e) none of these

12. $x + 2y = 6$
    $4x - 3y = 2$
    Find $x + y$

    a) 4 b) 7 c) 2 d) 11 e) 12

13. $y = 4x + 3$
    $6x - 7y = 1$
    Find $x + y$

    a) 8 b) 3 c) -2 d) 11 e) 9

14. $3x - 8y = 2$
    $x - 5y = -4$
    Find $x - y$

    a) -1 b) -4 c) 0 d) -10 e) none of these

15. $x + y = 1$
$2x + 3y = -2$
Find $2x + y$

a) 3 b) 6 c) -2 d) -6 e) none of these

Evaluate the following determinants.

16. $\begin{vmatrix} 3 & 4 \\ -2 & -3 \end{vmatrix}$

a) -1 b) 1 c) -17 d) 17 e) none of these

17. $\begin{vmatrix} 3 & -4 \\ 2 & 6 \end{vmatrix}$

a) 10 b) 26 c) 3 d) 15 e) none of these

18. $\begin{vmatrix} 3 & -1 \\ -2 & -4 \end{vmatrix}$

a) -10 b) 14 c) 12 d) -12 e) none of these

Given the system of equations: $4x + 3y = 10$
$5x - 2y = 1$

Select the determinants necessary to solve by using Cramer's rule.

19. the determinant for the numerator for x is

a) $\begin{vmatrix} 4 & 3 \\ 5 & -2 \end{vmatrix}$ b) $\begin{vmatrix} 3 & 10 \\ -2 & 1 \end{vmatrix}$ c) $\begin{vmatrix} 4 & 10 \\ 5 & 1 \end{vmatrix}$ d) $\begin{vmatrix} 10 & 4 \\ 1 & 5 \end{vmatrix}$ e) $\begin{vmatrix} 10 & 3 \\ 1 & -2 \end{vmatrix}$

20. the determinant for the numerator for y is

a) $\begin{vmatrix} 4 & 3 \\ 5 & -2 \end{vmatrix}$ b) $\begin{vmatrix} 10 & 3 \\ 1 & 2 \end{vmatrix}$ c) $\begin{vmatrix} 4 & 10 \\ 5 & 1 \end{vmatrix}$ d) $\begin{vmatrix} 10 & 4 \\ 1 & 5 \end{vmatrix}$ e) $\begin{vmatrix} 10 & 3 \\ 1 & -2 \end{vmatrix}$

21. the determinant for both denominators is

a) $\begin{vmatrix} 4 & 3 \\ 5 & -2 \end{vmatrix}$ b) $\begin{vmatrix} 10 & 3 \\ 1 & 2 \end{vmatrix}$ c) $\begin{vmatrix} 4 & 10 \\ 5 & 1 \end{vmatrix}$ d) $\begin{vmatrix} 10 & 4 \\ 1 & 5 \end{vmatrix}$ e) $\begin{vmatrix} 10 & 3 \\ 1 & -2 \end{vmatrix}$

22. Apply your answers to problems 19, 20 and 21 to solve the equation for x and y using Cramer's rule and find $x + 2y$.

a) 3 b) 4 c) 2 d) 6 e) 5

Given the following systems of equations, solve for the unknown as indicated.

23. $2x + 3y - 2z = -5$
$x - 2y + 3z = 13$
$3x - y + z = 10$

Solve for x.

a) 2 b) -1 c) 3 d) 16 e) none of these

24. $3x + y - z = 1$
$4x + y + 3z = 2$
$x + y - 4z = -1$

Solve for y.

a) -3 b) 1 c) 2 d) -2 e) none of these

25. $x + y + 3z = 1$
$2x - y + 4z = -2$
$3x - 2y + z = 1$

Solve for z.

a) 0 b) 2 c) 1 d) -2 e) none of these

1. The sum of two numbers is -18. The first number minus twice the second is 66. Find the numbers. The first number is

   a) -2 b) 24 c) 16 d) 10 e) 48

2. The perimeter of a rectangular lot is 72 ft. The length exceeds the width by 8 ft. What is the length?

   a) 32 ft. b) 14 ft. c) 22 ft. d) 40 ft. e) 28 ft.

3. An airliner leaves JFK travelling west at 540 mph. Two hours later a second airliner leaves on the same course but at 630 mph. How far west will the planes be when the second catches the first?

   a) 8190 miles b) 14 hrs. c) 7560 miles d) 12 hrs.

   e) none of these

4. A chemist has one solution of acid and water that is 20% acid and a second solution that is 60% acid. Find how many gallons of each should be mixed together to get 30 gallons of a solution that is 44% acid. The number of gallons of the 60% acid solution to be used is

   a) 18 g b) 16.8 g c) 24 g d) 12 g e) none of these

5. Three times the force in the left part of a structure is 500 N less than twice the force in the right part. The sume of the two forces multiplied by 4 is 2400 N. The force in the left part is

   a) 340 N b) 460 N c) 260 N d) 140 N e) none of these

6. An architect is laying out a parking lot. She finds she can put five parking spaces for compact cars and six spaces for standard cars into a 100 ft. lane. She can alternatively put ten compact and two standard spaces in the same lane. What width is she using for a compact car in her layout?

   a) 7 ft. b) 8 ft. c) 9 ft. d) 10 ft. e) 11 ft.

Find the indicated products and simplify.

7. $2x(3x - 2)(3x + 2)$

   a) $18x^3 - 8x$ b) $36x^4 - 16x^2$ c) $18x^3 - 12x^2 - 8x$

   d) $18x^3 - 12x^2 + 8x$ e) $18x^2 - 24x - 8$

8. $(t - 5)^3$

   a) $t^3 - 125$ b) $t^3 + 125$ c) $t^2 - 10t + 25$ d) $t^3 + 15t^2 + 75t - 125$

   e) $t^3 - 15t^2 + 75t - 125$

9. $(2a^2 + 4)(3 - a)$

   a) $2a^3 + 6a^2 - 4a + 12$ b) $6a^2 - 4a + 12$ c) $2a^3 + 6a^2 - 4a - 12$

   d) $-2a^3 + 6a^2 - 4a + 12$ e) $-2a^3 + 2a^2 + 12$

10. $(2x^2 - 4x + 3)(2x + 4)$

a) $4x^3 - 22x + 12$ b) $4x^3 - 10x + 12$ c) $4x^3 - 16x^2 - 10x + 12$
d) $4x^3 + 16x^2 - 10x + 12$ e) $4x^3 - 16x^2 - 22x + 12$

11. $(3 - x - y)^2$

a) $9 + x^2 + y^2$ b) $9 - x^2 - y^2$ c) $9 + 2xy + x^2 + y^2$
d) $x^2 + 2xy + y^2 - 6x - 6y + 9$ e) $x^2 + 2xy + y + 6x + 6y + 9$

12. $6a(x + 2b)^2$

a) $36a^2(x^2 + 4bx + 4b^2)$ b) $6ax^2 + 24ab^2$ c) $6ax^2 + 24abx + 24ab^2$
d) $6a(x^2 + 2bx + 4b^2)$ e) $6ax^2 + 24abx + 4b^2$

13. $(x - y + 1)(x - y - 1)$

a) $(x - y)^2 - 1$ b) $x^2 - 2xy + y^2 + 2x - 2y - 1$ c) $x^2 - 2xy + y^2 + 1$
d) $x^2 - 2xy - y^2 - 1$ e) $x^2 - 2xy + y^2 - 2y - 1$

14. $(3a + y)(2a - 7y)$

a) $6a^2 - 7y^2$ b) $6a - 19ay - 7y$ c) $6a^2 - 19ay - 7y^2$
d) $6a^2 - 18ay - 7y^2$ e) $6a^2 - ay - 7y^2$

Factor completely.

15. $-4a^2b - 2ab + 6ab^2$

a) $2ab(-2a + 3b)$ b) $2ab(-2a + 1 + 3b)$ c) $-2ab(2a - 1 - 3b)$
d) $ab(-2 - 4a + 6b)$ e) none of these

16. $(x - 1)(y + 3) + (x - 1)(2y - 4)$

a) $(x - 1)(3y - 1)$ b) $(x - 1)(2y^2 + 2y - 12)$ c) $(x - 1)(y - 1)$
d) $(x - 1)(y + 3)$ e) $(x - 1)(3y + 1)$

17. $-36a^2 + 25b^2$

a) $(6a + 5b)^2$ b) $(-6a + 5b)^2$ c) $(6a + 5b)(6a - 5b)$
d) $(-6a + 5b)(6a + 5b)$ e) $(-6a - 5b)(6a + 5b)$

18. $64 - y^3$

a) $(4 - y)^3$ b) $(4 + y)(16 + 4y - y^2)$ c) $(4 - y)(16 + 4y + y^2)$
d) $(8 - y)^3$ e) $(4 + y)(16 - 4y - y^2)$

19. $3x(xy - 2) + 5(2 - xy)$

a) $xy(3x - 5) + 2(5 - 3x)$ b) $(xy - 2)(3x - 5)$ c) $(5 + 3x)(xy - 2)$
d) $5(2 - xy) - 3x(2 + xy)$ e) not factorable

20. $(c + 4)^2 - 4d^2$

a) $(c + 8 - 2d)(c + 8 + 2d)$ b) $(c + 4 - 2d)^2$ c) $(c + 4 - 2d)(c + 8 + 2d)$
d) $(c + 4 - 2d)(c + 4 + 2d)$ e) not factorable

21. $3x^3 + 6x^2 - 24x$

a) $(x - 2)(x + 4)$ b) $3x(x - 2)(x + 4)$ c) $3(x^2 - 2x)(x + 4)$
d) $3x(x + 2)(x - 4)$ e) $x(x - 2)(3x + 12)$

22. $12s^2 - 60s + 75$

a) $3(4s^2 + 15s + 75)$ b) $3(2s - 5)^2$ c) $3(2s - 5)(2s + 5)$
d) $3(4s^2 - 15s + 75)$ e) not factorable

Factor <u>completely</u>. One factor will be

23. $9x^2y^4 - 16x^4$

a) $9y^4 - 16x^2$ b) $3xy^2 - 4x^2$ c) $3y^2 - 4x$ d) x e) $3y^2 + 4x^2$

24. $4x^2 - 20x + 25$

a) $2x - 5$ b) $2x + 5$ c) $x - 5$ d) $x + 5$ e) none of these

25. $2w^2 + 7w - 15$

a) $2w - 5$ b) $w + 3$ c) $2w - 3$ d) $w - 5$ e) $2w + 5$

Reduce the fraction to lowest terms.

1. $\frac{6x^{12}y}{12x^4y^7} =$

a) $\frac{1}{2} \cdot \frac{x^8}{y^6}$ b) $\frac{x^3}{2y^6}$ c) $2x^8y^6$ d) $\frac{x^3}{2y^7}$ e) $\frac{1}{2} \cdot \frac{x^3}{y^7}$

2. $\frac{y^{10} - y^2}{y^{18} - y^{10}} =$

a) $-\frac{1}{y^{16}}$ b) $\frac{1}{y^{16}}$ c) $-\frac{1}{y^9}$ d) $\frac{1}{y^5}$ e) $\frac{1}{y^8}$

3. $\frac{x + 4}{(x + 5)x + 4}$

a) $\frac{1}{x + 5}$ b) $\frac{4}{x + 9}$ c) $\frac{1}{x + 1}$ d) 0 e) none of these

4. $\frac{3t + 27u}{9t + 18u}$

a) $\frac{t + 9u}{3(t + 2u)}$ b) $\frac{30}{27}$ c) $\frac{t + 9u}{3(t + 6u)}$ d) $\frac{t + 3u}{3t + 2u}$ e) none of these

5. $\frac{x^{18}(y - 2)}{x^9(2 - y)}$

a) $-x^2$ b) $-x^9$ c) x^2 d) x^9 e) -9

6. $\frac{ax^2 - ay^2}{x - y}$

a) $a(x + y)$ b) $a(x - y)$ c) a d) $x - y$ e) $x + y$

7. $\frac{u^2 + 2u - 8}{2u^2 + 5u - 12}$

a) $\frac{6}{5}$ b) $\frac{u^2 - 8}{5u - 12}$ c) $\frac{u - 2}{2u - 3}$ d) $\frac{2}{3}$ e) none of these

8. $\frac{u^2 + 2u - 15}{u^2 - 9u + 18}$

a) $-\frac{5}{6}$ b) $\frac{u + 5}{u - 6}$ c) $\frac{u - 5}{u + 6}$ d) $\frac{-13}{9}$ e) $\frac{-6}{5}$

Carry out the indicated operations and simplify.

9. $\frac{6x^2yz^3}{15xy^7z^6} \cdot \frac{30y^2z^3}{7x^3}$

a) $\frac{12z^3}{7xy^5}$ b) $\frac{12}{7x^2y^4}$ c) $\frac{4y^4}{7x}$ d) $\frac{4x^2y^4}{7}$ e) none of these

10. $\frac{s^2 + st}{ab} \cdot \frac{a + b}{t^2 + st} =$

a) $\frac{s(a + b)}{abt}$ b) $\frac{s^2}{t^2}$ c) $\frac{s}{t}$ d) $\frac{s^2 + a + b}{ab + t^2}$ e) $\frac{s^2 + 2}{1 + t^2}$

11. $\frac{6r^3s^2}{4t^2} \div \frac{9s^3}{16rt^5} =$

a) $\frac{8rt}{6s}$ b) $\frac{8r^3t^3}{3s}$ c) $\frac{8r^4t^3}{3s}$ d) $\frac{27r^2s^6}{32t^{10}}$ e) $\frac{8r^2s^6}{3t^{10}}$

12. $\frac{3x^2y^5}{z^4} \cdot \frac{x^3y^7z^5}{9z^2} \cdot \frac{21x^2}{10y^2}$

a) $\frac{7x^7y^{10}}{10z}$ b) $\frac{7x^{12}y^{32}}{30z^3}$ c) $\frac{7x^{12}y^{32}}{10z^3}$ d) $\frac{7x^{12}y^{21}}{10z^3}$ e) $\frac{7x^7y^{25}}{10z}$

13. $\frac{x^2 - y^2}{(x - y)^2} \cdot \frac{1}{x + y}$

a) $\frac{1}{x + y}$ b) $\frac{1}{x - y}$ c) $-\frac{1}{x + y}$ d) $-\frac{1}{2xy(x + y)}$ e) none of these

14. $\frac{2x^2 + 7x + 3}{x^2 + 2x - 3} \div \frac{2x + 1}{x^2 - 1}$

a) $\frac{(2x + 1)^2}{(x - 1)^2(x + 1)}$ b) $\frac{2x + 1}{x^2 - 1}$ c) $-\frac{7x + 1}{x^2 - 1}$ d) $x + 1$ e) $x - 1$

15. $\frac{t^2 - s^2}{s^2 + 2st + t^2} \cdot \frac{2ut + 2us}{5st - 5t^2}$

a) $\frac{2}{5} \cdot \frac{u}{t}$ b) $-\frac{2u}{5t}$ c) $\frac{4u}{-5t^2}$ d) $\frac{2us}{5t}$ e) $\frac{ut + u}{st}$

16. $\frac{x^2 - 4}{x + 2y} \div \frac{x + 2}{x^2 - xy - 6y^2}$

a) $\frac{-4}{-xy - 6y^2}$ b) $\frac{(x^2 - 4)(x + 2)}{(x - 3y)(x + 2y)^2}$ c) $\frac{-4}{xy - 6y^2}$ d) $\frac{-4}{2 - xy - 6y^2}$

e) $(x - 2)(x - 3y)$

17. $\frac{x - 2}{x} \cdot \frac{x + 2}{x^2 + 4x - 32} \div \frac{2x^2 - 8}{xy + 8y}$

a) $\frac{2(x^2 - 4)^2}{xy(x + 8)^2(x - 4)}$ b) $\frac{2}{xy(x + 8)^2}$ c) $\frac{2x^2}{xy + y}$ d) $\frac{y}{2x(x - 4)}$

e) $\frac{y}{x(x - 4)}$

18. $2\frac{1}{10} - 3\frac{2}{15} =$

a) $-\frac{26}{25}$ b) $\frac{53}{25}$ c) $\frac{31}{30}$ d) $\frac{11}{5}$ e) $-\frac{31}{30}$

19. $\frac{a+2}{3a} - \frac{a-1}{4a} + \frac{a+1}{12a}$

a) $\frac{a+4}{3a}$ b) $\frac{a+4}{19a}$ c) $\frac{a+6}{6a}$ d) $\frac{2a+1}{a}$ e) $\frac{a+3}{6a}$

20. $\frac{3p}{2qr} - \frac{6q}{pr} + \frac{r}{3pq}$

a) $\frac{3p-6q+r}{4pqr}$ b) $\frac{3p-6q+r}{2qr+pr+3pq}$ c) $\frac{9p^2-36q^2+2r^2}{6pqr}$

d) $\frac{3p^2-6q^2+r^2}{6pqr}$ e) $\frac{9p^2qr-36pq^2r+6pqr^2}{6pqr}$

21. $\frac{2x}{2x-3y} + \frac{3y}{3y-2x}$

a) $-\frac{1}{3y} + \frac{1}{2x}$ b) $-\frac{1}{3y} - \frac{1}{2x}$ c) 1 d) $\frac{2x+3y}{0}$ e) $\frac{2x+3y}{2x-3y}$

22. $\frac{b^2+1}{b^2-1} - \frac{b-1}{b+1}$

a) $\frac{2b}{b^2-1}$ b) $-\frac{2b}{b^2-1}$ c) $\frac{2}{b^2-1}$ d) 2 e) -1

23. $\frac{z}{(z-4)(z-5)} + \frac{4}{(z-4)}$

a) $\frac{5}{z-5}$ b) $\frac{5(z-1)}{(z-4)(z-5)}$ c) $\frac{z+4}{(z-4)(z-5)}$ d) $-\frac{1}{z-5}$

e) $\frac{z+4}{2(z-4)(z-5)}$

24. $\frac{x}{(x+5)^2} + \frac{3x+1}{x+5}$

a) $\frac{4x+1}{(x+5)^3}$ b) $\frac{4x+1}{2(x+5)}$ c) $\frac{5x+6}{(x+5)^2}$ d) $\frac{3x^2+17x+5}{(x+5)^2}$

e) $\frac{3x^2+2x+5}{(x+5)^2}$

25. $\frac{x}{(x-3)^2} + \frac{5}{x-3} + \frac{4}{x+2}$

a) $\frac{x+9x^3}{(x-3)^3(x+2)}$ b) $\frac{x^3}{(x-3)^2(x+2)}$ c) $\frac{9x^2-43x+6}{(x-3)^2(x+2)}$

d) $\frac{x+9}{2(x-3)^2(x+2)}$ e) $\frac{10x^2-27x+6}{(x-3)^2(x+2)}$

Combine and simplify.

1. $\dfrac{3}{3 - \frac{1}{5}}$

a) $-\frac{1}{5}$ b) -5 c) $\frac{15}{4}$ d) $\frac{5}{4}$ e) $\frac{15}{14}$

2. $\dfrac{2 + \frac{2}{3}}{4 + \frac{1}{9}} =$

a) 3 b) $\frac{24}{37}$ c) 6 d) $\frac{3}{2}$ e) $\frac{12}{5}$

3. $\dfrac{4 - \frac{1}{z}}{16 - \frac{1}{z^2}}$

a) $\frac{1}{4 - z}$ b) $\frac{z}{4z + 1}$ c) $\frac{4z - 1}{16z^2 - 1}$ d) $\frac{z - 1}{4z - 1}$ e) $\frac{1}{4} - z$

4. $\dfrac{(x + h)^2 - x^2}{h}$

a) 1 b) h c) $2x + h^2$ d) $2xh + h$ e) $2x + h$

5. $\dfrac{\frac{x}{y} - \frac{y}{x}}{\frac{2}{x} - \frac{2}{y}}$

a) $\frac{x - y}{2}$ b) $-\frac{(x + y)}{2}$ c) $\frac{x - y}{0}$ d) $\frac{x + y}{2}$ e) $\frac{x^2 - y^2}{2xy}$

6. $\dfrac{1}{\frac{1}{x} + \frac{1}{y + z}}$

a) $x + y + z$ b) $x(y + z)$ c) $\frac{x(y + z)}{x + y + z}$ d) $\frac{1}{x + y + z}$

e) $\frac{xy + z}{x + y + z}$

7. $\dfrac{\frac{1}{(x + h)^2} - \frac{1}{x^2}}{h}$

a) $\frac{2x + h}{(x + h)^2 x^2}$ b) $\frac{h}{(x + h)^2 x^2}$ c) $\frac{1 + 2x + h^2}{(x + h)^2}$ d) $\frac{-2x - h}{(x + h)^2 x^2}$

e) $\frac{-h}{(x + h)^2 x^2}$

Solve each equation for x.

8. $\frac{4}{x} - \frac{2}{9} = 2$

The answer lies between the following real numbers:

a) 0 and 5 b) 5 and 10 c) -5 and -1 d) 11 and 15 e) 100 and 105

9. $\frac{x - 2}{x + 3} = \frac{x + 2}{x + 6}$

The answer lies between the following real numbers:

a) -30 and -1 b) -57 and -40 c) 0 and 14 d) 20 and 80
e) 150 and 200

10. $\frac{2x + 4}{6} - \frac{3x + 5}{9} = \frac{x}{3}$

a) $\frac{11}{3}$ b) $\frac{1}{3}$ c) $-\frac{1}{3}$ d) $-\frac{11}{3}$ e) none of these

11. $\frac{x + 1}{x - 7} + 3 = \frac{4}{x - 7}$

The answer lies between the following real numbers:

a) -10 and 2 b) 3 and 7 c) 8 and 17 d) 20 and 31
e) -100 and -50

12. $\frac{12}{x^2 - 16} + \frac{3x}{x - 4} = 3$

The answer lies between the following real numbers:

a) -100 and -50 b) 4 and 10 c) -3 and 2 d) -6 and -4
e) 71 and 100

13. $\frac{2}{x - 1} - \frac{1}{x} = \frac{2}{x(x - 1)}$

a) 0 b) 2 c) 1 d) no solution e) none of these

14. Solve the formula for A: $\frac{3}{A} = \frac{B}{B - A}$

a) $\frac{B}{2}$ b) $\frac{3B}{B + 3}$ c) 1 d) $\frac{3}{4}$ e) $\frac{B}{B + 1}$

Find <u>all</u> the roots of each of the quadratic equations by the method of factoring.

15. $x^2 = 5$

a) $\sqrt{5}$ b) $-\sqrt{5}$ c) 2 d) $\sqrt{5}, -\sqrt{5}$ e) none of these

16. $3(x + 2.1)(x - 13) = 0$

a) 3, -2.1, 13 b) 3, 2.1 c) 3, 2.1, -13 d) 2.1, 13 e) -2.1, 13

17. $x^2 + 2x - 3 = 0$

a) 0, -3 b) 1, -3 c) 0, 1, -3 d) 0, 1 e) -1, 3

18. $2x^2 + 18x + 40 = 0$

a) 2, 5, 4 b) 2, -5, -4 c) -5, -4 d) 2, 18, 40 e) 1, 9, 20

19. $x^2 - 2x - 8 = 7$

a) 4, -2 b) -4, 2 c) -5, 3 d) -3, 5 e) 1

20. $(x - 1)(x + 2) = 4$

a) 5, 2 b) -2, 3 c) 1, -2 d) 3, 6 e) 2, -3

21. $2.5(x + \sqrt{3})^2 = 0$

a) 2.5 b) 2.5, $\sqrt{3}$, $-\sqrt{3}$ c) $\sqrt{3}$, $-\sqrt{3}$ d) $-\sqrt{3}$, $-\sqrt{3}$ e) none of these

22. $(x + 3)^2 = -16$

a) $-3 - 4j$, $-3 + 4j$ b) -7, 1 c) -19, 13 d) $3 - 4j$, $-3 + 4j$
e) $-3 + 4j$, $-3 + 4j$

Solve the quadratic equation by completing the square. Choose the equivalent equation.

23. $x^2 + 6x = 5$

a) $(x + 6)^2 = 11$ b) $(x + 3)^2 = 8$ c) $(x + 3)^2 = 14$
d) $(x + 3)^2 = -4$ e) $(x + 6)^2 = 41$

24. $x^2 - 5x = 8$

a) $(x - \frac{5}{2})^2 = 8 + \frac{25}{4}$ b) $(x - \frac{5}{2})^2 = 8 - \frac{25}{4}$ c) $(x - \frac{5}{2})^2 = 8 - \frac{5}{2}$
d) $(x - 5)^2 = 8 + 25$ e) $(x - 5)^2 = 8 - 25$

25. $4x^2 + 12x = 20$

a) $(x + 12)^2$ b) $(2x + 4)^2 = 36$ c) $(x + \frac{3}{2})^2 = 20 - \frac{9}{4}$
d) $(x + 6)^2 = -16$ e) $(x + \frac{3}{2})^2 = 5 + \frac{9}{4}$

Solve each equation by the quadratic formula. Simplify.

1. $x^2 + 6x + 4 = 0$

   a) $\frac{3\pm\sqrt{13}}{2}$ b) $-3\pm\sqrt{5}$ c) $-6\pm\sqrt{5}$ d) $\frac{6\pm\sqrt{20}}{2}$ e) none of these

2. $2x^2 + 9 = 0$

   a) $\pm\frac{3\sqrt{2}\,j}{2}$ b) $\pm j\sqrt{\frac{9}{2}}$ c) $\pm\frac{9}{2}j$ d) $\frac{3}{\sqrt{2}}j$ e) $\pm\frac{2}{\sqrt{3}}j$

3. $3x^2 - 3x - 2 = 0$

   a) $\frac{1\pm\sqrt{11}}{2}$ b) $\frac{3\pm j\sqrt{15}}{6}$ c) $\frac{-3\pm\sqrt{33}}{6}$ d) $\frac{-1\pm\sqrt{33}}{2}$ e) none of these

4. $2x^2 = 8x - 5$

   a) $4\pm\sqrt{26}$ b) $\frac{4\pm\sqrt{24}}{2}$ c) $8\pm\sqrt{6}$ d) $\frac{4\pm\sqrt{6}}{2}$ e) none of these

5. $2x^2 - 3x + 1 = 0$

   a) $\frac{3\pm\sqrt{17}}{4}$ b) $\frac{3\pm\sqrt{17}}{2}$ c) $\frac{7}{4}, -\frac{1}{4}$ d) $1, \frac{1}{2}$ e) none of these

Determine the nature of the roots for the following equations (Use the discriminant). Select one of these answers for problems 6 through 10.

a) Exactly one real number solution
b) Two real, rational number solutions
c) Two nonreal solutions
d) One real and one nonreal solution
e) Two real, irrational number solutions

6. $x^2 - 2x = -4$

7. $4x^2 - 12x + 9 = 0$

8. $x^2 - 2 = 0$

9. $2x^2 - 7x + 6 = 0$

10. $y^2 - 4y + \frac{9}{4} = 0$

11. Find the smallest positive angle coterminal with an angle of -127°

    a) 53° b) 37° c) 143° d) 233° e) 127°

12. Find an angle that is coterminal with an angle of 125°

    a) -125° b) 235° c) 35° d) 55° e) none of these

13. In which quadrant does the terminal side of an angle of -212° lie?

    a) one b) two c) three d) four e) five

Use the information given in problems 14 through 19 to fill in the blanks.

Find the _____ of the angle in standard position that has the point _____ on its terminal side. (Simplify)

14. sin, (3,5)

a) $\frac{5}{3}$ b) $\frac{\sqrt{34}}{3}$ c) $\frac{3\sqrt{34}}{34}$ d) $\frac{5\sqrt{34}}{34}$ e) $\frac{\sqrt{34}}{5}$

15. cos, $(\sqrt{7},2)$

a) $\frac{\sqrt{7}}{2}$ b) $\frac{2\sqrt{7}}{7}$ c) $\frac{11\sqrt{7}}{7}$ d) $\frac{2}{11}$ e) $\frac{\sqrt{77}}{11}$

16. tan, (5,6)

a) $\frac{6}{5}$ b) $\frac{5}{6}$ c) $\frac{6\sqrt{61}}{61}$ d) $\frac{\sqrt{61}}{6}$ e) $\frac{\sqrt{61}}{5}$

17. cot, $(\sqrt{2},1)$

a) $\frac{3\sqrt{2}}{3}$ b) $\sqrt{2}$ c) $\frac{\sqrt{2}}{2}$ d) $\sqrt{3}$ e) $\frac{2\sqrt{3}}{3}$

18. sec, $(\sqrt{11},2)$

a) $\frac{\sqrt{11}}{2}$ b) $\frac{\sqrt{143}}{11}$ c) $\frac{\sqrt{165}}{11}$ d) $\frac{\sqrt{165}}{15}$ e) $\frac{2\sqrt{11}}{11}$

19. csc, (8,3)

a) $\frac{\sqrt{73}}{8}$ b) $\frac{3}{8}$ c) $\frac{8}{3}$ d) $\frac{3\sqrt{73}}{3}$ e) $\frac{\sqrt{73}}{3}$

20. If $\sin\theta = \frac{2}{9}$, find $\sec\theta$.

a) $\frac{2}{7}$ b) $\frac{9\sqrt{77}}{77}$ c) $\frac{7}{9}$ d) $\frac{2\sqrt{85}}{85}$ e) $\frac{\sqrt{77}}{9}$

21. If $\cos\theta = \frac{1}{4}$, find $\csc\theta$.

a) $\sqrt{15}$ b) $\sqrt{17}$ c) $\frac{\sqrt{15}}{4}$ d) $\frac{\sqrt{17}}{4}$ e) $\frac{4\sqrt{15}}{15}$

22. If $\tan\theta = \frac{3}{7}$, find $\cos\theta$.

a) $\frac{7\sqrt{58}}{58}$ b) $\frac{3\sqrt{41}}{41}$ c) $\frac{3\sqrt{58}}{58}$ d) $\frac{\sqrt{58}}{7}$ e) $\frac{10}{7}$

23. If $\cot\theta = \frac{2}{3}$, find $\sin\theta$.

a) $\frac{3\sqrt{13}}{3}$ b) $\frac{\sqrt{13}}{3}$ c) $\frac{\sqrt{5}}{3}$ d) $\frac{3\sqrt{5}}{5}$ e) $\frac{3\sqrt{13}}{13}$

24. If $\sec\theta = \frac{\sqrt{7}}{2}$, find $\tan\theta$.

a) $\frac{2\sqrt{3}}{3}$ b) $\frac{\sqrt{21}}{3}$ c) $\frac{\sqrt{3}}{2}$ d) $\frac{\sqrt{21}}{7}$ e) $\sqrt{15}$

25. If $\csc \theta = 2$, find $\cot \theta$.

a) $\frac{1}{2}$ b) $\frac{\sqrt{3}}{2}$ c) $\frac{\sqrt{3}}{3}$ d) $\sqrt{3}$ e) $\frac{2\sqrt{3}}{3}$

Determine the exact value of each trigonometric function.

1. $\cos 90^\circ$

   a) undefined b) $\frac{\sqrt{3}}{3}$ c) 1 d) $\sqrt{3}$ e) 0

2. $\cot 60^\circ$

   a) $\sqrt{3}$ b) $\frac{\sqrt{3}}{3}$ c) $\frac{2\sqrt{3}}{3}$ d) $\frac{\sqrt{3}}{2}$ e) $\frac{1}{2}$

3. $\sec 45^\circ$

   a) undefined b) 1 c) $\frac{\sqrt{2}}{2}$ d) $\sqrt{2}$ e) 0

4. $\cos 30^\circ$

   a) $\frac{\sqrt{3}}{3}$ b) $\frac{\sqrt{2}}{2}$ c) $\frac{1}{2}$ d) $\sqrt{3}$ e) $\frac{\sqrt{3}}{2}$

Determine the exact value of each trigonometric function of θ, $0^\circ \leq \theta \leq 90^\circ$.

5. If $\sec \theta = 2$, find $\tan \theta$.

   a) $\frac{\sqrt{3}}{3}$ b) $\sqrt{3}$ c) $\frac{\sqrt{3}}{2}$ d) $\frac{2\sqrt{3}}{3}$ e) $\sqrt{2}$

6. If $\cos \theta = 1$, find $\csc \theta$.

   a) 1 b) 0 c) undefined d) $\frac{1}{2}$ e) $\sqrt{2}$

7. If $\tan \theta = 1$, find $\sin \theta$.

   a) $\frac{\sqrt{2}}{2}$ b) $\sqrt{2}$ c) 2 d) $\frac{1}{2}$ e) 1

8. If $\cos \theta = \frac{\sqrt{3}}{2}$, find $\cot \theta$.

   a) $\frac{1}{2}$ b) $\frac{\sqrt{3}}{2}$ c) 2 d) $\sqrt{3}$ e) $\frac{2\sqrt{3}}{3}$

9. If $\tan \theta$ = undefined, $\cos \theta$ =

   a) 0 b) 1 c) $\frac{1}{2}$ d) $\frac{\sqrt{2}}{2}$ e) undefined

Use a trigonometric table to find the value of the trigonometric function.

10. $\cot 34^\circ 20'$

    a) 1.211 b) 1.455 c) 1.464 d) 1.473 e) 0.8258

11. $\sin 49^\circ 10'$

    a) 0.6539 b) 0.7566 c) 0.7451 d) 0.6670 e) 1.157

Use a trigonometric table to find θ to the nearest 10', $0^\circ \leq \theta \leq 90^\circ$.

12. $\cos \theta = 0.9001$

a) $64^\circ 10'$ b) $26^\circ 50'$ c) $65^\circ 10'$ d) $25^\circ 50'$ e) none of these

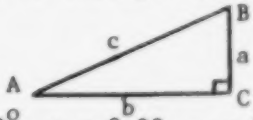
13. $\tan \theta = 1.511$

a) $34^\circ 30'$ b) $57^\circ 30'$ c) $33^\circ 30'$ d) $57^\circ 20'$ e) $56^\circ 30'$

14. $\sec \theta = 3.450$

a) $16^\circ 50'$ b) $73^\circ 10'$ c) 17° d) $74^\circ 10'$ e) $16^\circ 10'$

For problems 15 through 19, refer to the following diagram.



15. $B = 52.0^\circ$, $a = 8.00$, $c = ?$

a) 4.93 b) 12.99 c) 10.15 d) 6.30 e) 10.24

16. $a = 15.0$, $b = 11.0$, $B = ?$

a) 47.2° b) 53.7° c) 42.8° d) 36.3° e) none of these

17. $c = 27.5$, $a = 18.8$, $A = ?$

a) 43.1° b) 55.6° c) 46.9° d) 34.4° e) none of these

18. $B = 6^\circ 15'$, $b = 22.6$, $a = ?$

a) 2.5 b) 22.5 c) 207.7 d) 209.7 e) 206.4

19. $A = 20^\circ 40'$, $c = 7.26$, $a = ?$

a) 20.57 b) 6.79 c) 2.56 d) 7.76 e) none of these

20. A hook and ladder 125 ft. long is extended at a $55^\circ 20'$ angle. What vertical distance can the top of the ladder reach?

a) 71 ft. b) 181 ft. c) 152 ft. d) 220 ft. e) 103 ft.

21. If a pole 48.2 ft. casts a 25.0 ft. shadow, what is the angle of elevation of the sun to the nearest 10'?

a) $27^\circ 20'$ b) $62^\circ 40'$ c) $31^\circ 10'$ d) $58^\circ 50'$ e) none of these

22. A jet flying at 620 mi/hr climbs at an angle of $12^\circ 30'$. What is its gain in altitude in 5 min.?

a) 137 mi. b) 11.2 mi. c) 11.5 mi. d) 50.4 mi. e) 134 mi.

23. A tunnel must be dug to the bottom of a 200 ft. well from a point 40 ft. away from and level with the top of the well. At what angle with respect to the horizontal (to the nearest degree) must the tunnel be slanted?

a) 11° b) 78° c) 79° d) 12° e) 5°

24. The angle of elevation between a ground observer and a second story window is $48^{\circ}10'$. The angle of elevation between the observer and the third story window is $54^{\circ}0'$. If the observer is 40.0 ft. from the building, what is the distance between the second and third stories?

a) 10.4 ft. b) 2.6' c) 4.1' d) 44.7' e) 99.7 ft.

25. An airplane pilot finds the angle of depression of a beacon light on the ground to be $14^{\circ}20'$. His altimeter shows that he is 400 m high. How far does he estimate his ground distance to be from the beacon?

a) 102 m b) 388 m c) 99 m d) 1616 m e) 1565 m

Perform the indicated operations and simplify. Write the results without zero or negative exponents.

1. $\left(\frac{8s^3}{4st^2}\right)^2$

   a) $\frac{8s^4}{t^4}$ b) $\frac{8s^3}{t^4}$ c) $\frac{4s^3}{t^4}$ d) $\frac{2s^4}{t^4}$ e) $\frac{4s^4}{t^4}$

2. $\left(\frac{x^{-4}y^3}{z^{-5}}\right)^{-3}$

   a) $\frac{x^7}{z^8}$ b) $\frac{x^{12}}{y^9z^{15}}$ c) $\frac{z^8}{x^7}$ d) $\frac{x^{12}}{z^{15}}$ e) none of these

3. $\frac{14r^6s^4t^{-2}}{35r^{-2}s^5t}$

   a) $\frac{2r^4}{5st^3}$ b) $\frac{2r^4}{5s^9t^3}$ c) $\frac{2r^8}{5st^3}$ d) $\frac{2r^8}{7st}$ e) $\frac{2r^4}{7st^3}$

4. $\left(\frac{-2x^3y^{-2}}{z^{-3}}\right)^4$

   a) $\frac{-16x^{12}z^{12}}{y^8}$ b) $\frac{-8x^{12}z^{12}}{y^8}$ c) $\frac{16x^7y^2}{z}$ d) $\frac{-2x^7y^2}{z}$ e) none of these

5. $\frac{18w^0z^{-4}}{16w^{-2}z^2}$

   a) $\frac{9w^2}{8z^6}$ b) $\frac{9w^3}{8z^2}$ c) $\frac{9w^3}{8z^6}$ d) $\frac{9z^2}{8w^2}$ e) none of these

6. $\left(-\frac{8}{125}\right)^{2/3}$

   a) $-\frac{2}{5}$ b) $\frac{2}{5}$ c) $-\frac{4}{25}$ d) $\frac{4}{25}$ e) $\frac{25}{4}$

7. $(7^{1/4})(7^{2/3})$

   a) $7^{1/6}$ b) $49^{11/12}$ c) $49^{1/6}$ d) $7^{11/12}$ e) none of these

8. $\frac{3^0x^2y^{-3}}{3^{-1}x^{1/3}y^{-1/4}}$

   a) $\frac{3x^{5/3}}{y^{13/4}}$ b) $\frac{3x^{2/3}}{y^{3/4}}$ c) $\frac{x^{7/3}}{3y^{11/4}}$ d) $\frac{x^{2/3}}{3y^{11/4}}$ e) none of these

9. $\left(\frac{y^{2/3}}{y^{-1/6}}\right)^{-2}$

   a) $\frac{1}{y^{5/6}}$ b) $\frac{1}{y^{5/3}}$ c) $y^{5/6}$ d) $y^{5/3}$ e) none of these

10. $(16a^{-4}b^{10}c^{0})^{1/2}$

a) $\frac{a^2}{4b^5}$ b) $\frac{4b^5}{a^2}$ c) $\frac{4b^5c^{1/2}}{a^2}$ d) $\frac{8b^5}{a^2}$ e) none of these

Simplify the following radical expressions.

11. $\sqrt{50x^6y^5}$

a) $x^3\sqrt{50y}$ b) $5x^2\sqrt{2y}$ c) $25x^2\sqrt{2x^2y^5}$ d) $x^2y^2\sqrt{50xy}$ e) $5x^3y^2\sqrt{2y}$

12. $4\sqrt{28} - 2\sqrt{63} + 5\sqrt{7}$

a) $7\sqrt{28}$ b) $14\sqrt{7}$ c) $7\sqrt{7}$ d) $2\sqrt{28} + 5\sqrt{7}$ e) none of these

13. $8\sqrt{\frac{3}{16}} + \sqrt{48}$

a) $8\sqrt{\frac{51}{16}}$ b) $2\sqrt{51}$ c) $8\sqrt{\frac{3}{4}} + 2\sqrt{3}$ d) $6\sqrt{3}$ e) none of these

14. $\sqrt{\frac{2x^3y^5}{3}}$

a) $xy^2\sqrt{\frac{2}{3}}$ b) $\frac{xy}{3}^2\sqrt{6xy}$ c) $\sqrt{\frac{16x^3y^5}{3}}$ d) $2xy^2\sqrt{\frac{xy}{3}}$ e) none of these

15. $8\sqrt{20} + \frac{25}{\sqrt{5}}$

a) $8\sqrt{20} + 5$ b) $16\sqrt{5}$ c) $21\sqrt{5}$ d) $13\sqrt{5}$ e) none of these

16. $\sqrt[3]{6x^2y}\ \sqrt[3]{4xy}$

a) $2x\sqrt[3]{6y}$ b) $2x\sqrt[3]{3y^2}$ c) $xy\sqrt[3]{24}$ d) $2\sqrt[3]{3x^3y^2}$ e) $\sqrt[9]{24x^3y^2}$

17. $\sqrt{x}(\sqrt{x} - \sqrt{y})$

a) $x - \sqrt{y}$ b) $x - \sqrt{xy}$ c) $x\sqrt{y}$ d) $-x\sqrt{xy}$ e) none of these

18. $(2\sqrt{a} - \sqrt{b})^2$

a) $2a - 4\sqrt{ab} + b$ b) $4a - 4\sqrt{ab} + b$ c) $4a + 4\sqrt{ab} + b$ d) $2a + b$

e) none of these

19. $(\sqrt{x} + \sqrt{y})(2\sqrt{x} - \sqrt{y})$

a) $2x - y$ b) $3\sqrt{x}$ c) $2x + \sqrt{xy} - y$ d) $2x + \sqrt{xy} + y$

e) none of these

20. $\sqrt{x}\sqrt[3]{y}$

a) $\sqrt[6]{x^3y^2}$ b) $\sqrt[3]{xy}$ c) $\sqrt{xy}$ d) $\sqrt[6]{x^6y^3}$ e) none of these

21. $\dfrac{\sqrt{3x}}{\sqrt{4y}}$

a) $\sqrt{3xy}$ b) $\dfrac{\sqrt{3xy}}{2y}$ c) $\dfrac{\sqrt{3x}}{2y}$ d) $\dfrac{3x}{x\sqrt{3xy}}$ e) none of these

22. $\dfrac{\sqrt[3]{2x}}{\sqrt[3]{y}}$

a) $\dfrac{2x}{\sqrt[3]{4x^2y}}$ b) $\dfrac{\sqrt[3]{2xy^2}}{y}$ c) $\dfrac{\sqrt[3]{2x}}{y}$ d) $\dfrac{\sqrt[3]{2xy}}{y}$ e) none of these

23. $\dfrac{2-\sqrt{5}}{3+\sqrt{5}}$

a) $\dfrac{11-5\sqrt{5}}{4}$ b) $\dfrac{1-\sqrt{5}}{14+6\sqrt{5}}$ c) $\dfrac{1-\sqrt{5}}{4}$ d) $\dfrac{11-5\sqrt{5}}{14+6\sqrt{5}}$ e) none of these

24. $\dfrac{1}{\sqrt{3}+\sqrt{2}}$

a) 1 b) $\dfrac{\sqrt{3}+\sqrt{2}}{5}$ c) $\dfrac{1}{5}$ d) $\dfrac{-\sqrt{2}}{\sqrt{3}+2}$ e) none of these

25. $\dfrac{2-\sqrt{x}}{3+\sqrt{x}}$

a) $\dfrac{6-5\sqrt{x}+x}{9-x}$ b) $\dfrac{6-x}{9-x}$ c) $\dfrac{2}{3}$ d) $\dfrac{2\sqrt{x}-x}{3}$ e) none of these

Solve for all (x,y) in each system of equations.

1. $xy = 12$
   $x + y = 7$

   a) (-3,-4), (4,3) b) (4,3), (3,4) c) (3,4) d) (4,3)
   e) (-4,-3), (3,4)

2. $y = x^2$
   $3x = y + 2$

   a) (1,2) b) $(2, \sqrt{2})$, (1,1) c) $(2, \pm\sqrt{2})$, $(1, \pm 1)$ d) (2,4), (1,1)
   e) none of these

3. $y^2 + 3x = 1$
   $x^2 - 2xy = 5$

   a) (1,-2), $(-\frac{5}{7}, \frac{22}{7})$ b) $(\frac{5}{7}, -\frac{8}{7})$, (-1,4) c) $(-\frac{5}{7}, \frac{16}{7})$, (1,-2)
   d) (1,4), $(-\frac{5}{7}, \frac{22}{7})$ e) none of these

4. $4x^2 + y^2 = 4$
   $2x + y = 2$

   a) (0,2) b) (0,1), (2,0) c) (0,2), (1,0) d) (0,-2), (-1,0)
   e) none of these

5. $x^2 + y^2 = 25$
   $x = y^2 - 5$

   a) (-5,0), (4,3), (4,-3) b) (0,-5), (3,4), (-3,4)
   c) (4,3) and (4,-3) d) (-5,0) e) none of these

6. $x^2 = 1 + y^2$
   $y^2 = 1 - x^2$

   a) (0,1) b) (0,1), (0,-1) c) (1,0) d) (-1,0) e) (1,0),(-1,0)

7. $2x^2 + 5y^2 = 22$
   $3x^2 - y^2 = -1$

   a) (1,2), (1,-2) b) (-1,2), (-1,-2) c) (2,1), (-2,1)
   d) (2,-1), (-2,-1) e) (1,2), (1,-2), (-1,2), (-1,-2)

8. $x^4 - 5x^2 + 6 = 0$

   a) $\pm\sqrt{2}, \pm\sqrt{3}$ b) 2,3 c) $\pm 2, \pm 3$ d) $\sqrt{2}, \sqrt{3}$ e) none of these

9. $3x^{-2} - 3x^{-1} - 18 = 0$

   a) $\pm \frac{1}{3}$ b) $\frac{1}{3}, -\frac{1}{2}$ c) $\frac{1}{2}, -\frac{1}{3}$ d) $\sqrt{\frac{1}{2}}$ e) none of these

10. $(2x + 1)^2 - 8(2x + 1) + 16 = 0$

a) $-\frac{5}{2}$ b) $\frac{2}{3},\frac{5}{2}$ c) $\frac{5}{2}$ d) $\frac{3}{2}$ e) none of these

11. $x - 10x^{1/2} + 16 = 0$

a) 2,8 b) $\sqrt{2},\sqrt{8}$ c) 16 d) 4,64 e) none of these

12. $x^{1/3} - 4x^{1/6} + 3 = 0$

a) 18,1 b) 27,1 c) 729,1 d) $\sqrt[6]{3},1$ e) $\sqrt[3]{3},1$

13. $x + 3\sqrt{x} = 4$

a) 16,1 b) 16 c) 1 d) $\pm 2j,\pm 1$ e) ± 1

14. $x^5 - 8x^3 + 15x = 0$

a) 0,3,5 b) $0,\pm\sqrt{3},\pm\sqrt{5}$ c) $0,\pm 3,\pm 5$ d) $\pm\sqrt{3},\pm\sqrt{5}$ e) $\pm 3,\pm 5$

15. $4 - \sqrt{3x} = 1$

a) $\frac{25}{3}$ b) $\frac{1}{3}$ c) $\frac{3}{25}$ d) 3 e) none of these

16. $\sqrt{x + 3} + 2x = 0$

a) $-\frac{3}{4},-1$ b) 1 c) $-\frac{3}{4},1$ d) $-\frac{3}{4}$ e) -1

17. $x - 2 = 2\sqrt{2x - 7}$

a) 8 b) 4 c) 8,4 d) 6,3 e) 9,2

18. $\sqrt[4]{3x - 1} = 2$

a) $\pm\frac{17}{3}$ b) $\frac{17}{3}$ c) $\frac{5}{3}$ d) $\frac{9}{3}$ e) none of these

19. $\sqrt{5x + 1} - 1 = 3\sqrt{x}$

a) -1 b) $\frac{9}{4}$ c) $\frac{1}{2}$ d) $0,\frac{9}{4}$ e) 0

20. $\sqrt{2x - 5} - \sqrt{x - 3} = 1$

a) 7,3 b) 3 c) $-\frac{3}{5}$ d) $\frac{3}{2},3$ e) none of these

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